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Description

Fuel pump

The invention relates to a fuel pump comprising an electromotive drive that has a commutator and carbon brushes which brush alternately against commutator segments as the commutator rotates.

Such fuel pumps are known. They are used, in particular, in motor vehicles and serve to deliver fuel from a fuel tank to the carburetor or to the injection system of an internal combustion engine. The electromotive drive is in this case provided by means of an electric motor having a commutator, a so-called commutator motor. The commutator is a cylindrical component coaxially seated on a shaft of the commutator motor and comprising copper bars with insulating spacers forming segments, to which so-called armature coils are connected. Current-carrying brushes of copper wire gauze or carbon brush on the commutator.

A disadvantage with these commutator motors is the wear, which is caused by the formation of pronounced oxide layers on the surface of the commutator and which reduces the service life of the motor. An especially strong oxide formation and thereby increased wear occurs in motors operating in a fuel environment. A known solution, in order to counteract the wear, is to provide a cleaning device in addition to the carbon brushes or incorporated into these, the cleaning device being intended, as the commutator rotates, to abrade the oxide layer forming on the commutator surface. Any cleaning of the carbon brushes is neither considered nor intended.

In a special embodiment of a fuel pump for specific fuels a carbon commutator is used in place of a copper commutator. This means that carbon segments rather than copper segments are used

in the commutator. The resulting disadvantage, especially in the context of fuels containing alcohol, which characteristically over time become electrically conductive, is that products of corrosion due to electrochemical processes are deposited on the running surfaces of the carbon brushes.

The object of the invention is therefore to create a fuel pump of the aforementioned type in which the running surfaces of the carbon brushes are kept free of the products of corrosion.

According to the invention this object is achieved in that the commutator segments contain graphite and at least one commutator segment contains graphite and an admixture of a material that has a greater hardness than graphite.

The use of graphite means that the commutator of the electric motor for driving the fuel pump according to the invention is very corrosion-resistant, particularly in an environment where there are fuels containing alcohol; this has a very positive effect on the service life of the fuel pump. At the same time the admixture of a harder material is particularly advantageous in achieving a cleaning of the carbon brushes bearing against the carbon segments during operation of the fuel pump, in that the admixture material gives rise to an abrasion, that is to say a scratching and micro-cutting, of the carbon brushes, particularly of the products of corrosion accumulating on the running surfaces of the carbon brushes. The admixture material therefore leads to a desired increase in the abrasive wearing by the commutator of the products of corrosion on the carbon brushes. Therefore no additional cleaning device or specially designed carbon brushes are necessary.

The admixture material could feasibly be provided, for example, in the form of striated solid material in the graphite. According to an advantageous further development of the invention, on the other hand, an especially efficient cleaning

of the carbon brushes and easy, inexpensive manufacturing of the commutator segments is achieved if the admixture material occurs in the form of individual particles in the graphite.

At the same time a uniform cleaning of the carbon brushes in the area of the overall contact surface on the commutator advantageously results if, according to a further development of the invention, the particles are uniformly dispersed in the respective commutator segments, which contain graphite with an admixture of the material having a greater hardness than graphite.

There are, in principle, no restrictions to the choice of admixture material. As tests with fuel pumps according to the invention have shown, however, it has proved particularly advantageous if, according to a further development of the invention, the admixture material is aluminum oxide.

The efficient cleaning action not withstanding, it has proved advantageous in order to avoid a possibly adverse influence on the electrical characteristics of the pairing of carbon brushes and commutator segments, if the proportion of the admixture material in the respective commutator segments, that is to say in the commutator segment(s) containing graphite with an admixture of the material having a greater hardness than graphite, is approximately 0.2%.

According to a further development of the invention an advantageous and particularly slender design shape of the fuel pump electromotive drive results if the commutator segments are oriented radially in relation to the commutator axis and the carbon brushes bear axially against the commutator segments. The commutator segments are in this case arranged at an end face of the commutator, against which the carbon brushes are axially pressed.

According to another advantageous development of the invention the commutator segments are oriented axially in relation to the commutator axis and the carbon brushes bear radially against the commutator segments, so that the drive unit of the fuel pump can be of a very short, flat design shape.

A significant cleaning of the carbon brushes can already be achieved through the rotation of the commutator and the resultant brushing of the carbon brushes over all commutator segments if just one commutator segment or some commutator segments contain the harder admixture material. For a particularly efficient cleaning of the carbon brushes whilst at the same time avoiding any imbalance of the commutator, it is on the other hand advantageous if, according to a further development of the invention, all commutator segments coming into contact with the carbon brushes contain the admixture material.

An exemplary embodiment of the invention is shown in the drawing and will be described in more detail below. The single figure shows a sectional view of a rotor of a fuel pump.

The figure depicts a rotor 1 of a commutator motor (not represented further) of a fuel pump. In operation of the fuel pump the rotor 1 having a rotor shaft 2 rotates about a rotor axis 4 and is provided with rotor windings 6. The ends of the rotor windings 6 have electrically conductive connections to terminals 8, 10 of contact tags 12, 14.

Commutator segments 16, 18, containing graphite and preferably composed of graphite, of a commutator 20 coaxially seated on the rotor shaft 2 are connected to the contact tags 12, 14. The commutator segments 16, 18 are therefore electrically connected to the rotor windings 6. The commutator segments 16, 18 of the commutator 20 are oriented radially in relation to the commutator axis corresponding to the rotor axis 4, and point

away from the commutator axis. As the rotor 1 and hence the commutator 20 rotates, as indicated by an arrow 22, carbon brushes 24, 26 preloaded by means of a spring device (not shown) brush alternately against the commutator segments; during one revolution of the rotor 1, therefore, both the upper commutator segment 16 and the lower commutator segment 18 in the figure will, for example, brush along the upper carbon brushes 24 in the figure.

It can further be seen that the commutator segments 16, 18 have an admixture of particles 28, which are uniformly dispersed in the commutator segments 16, 18 and are composed of a material 30, aluminum oxide. For the sake of clarity, the particles 28 are represented as oversized in relation to the commutator segments 16, 18.